CFAST Version 5 Update, August 1, 2002

Modeling of the fire environment is proceeding in several directions. One is real-time simulation of fire environment as a tactical aid for the fire service. The second is improving spatial resolution for more detailed calculations. The push for tactical decision information builds on the improvement of building sensing technology.

As we extend the capability of the zone models, we are encountering the inherent limitations of these types of models. The general concept of a zone or control volume model uses volume as one of the variables. Inherently there is no spatial information available.

The first deviation from this viewpoint was the necessity of including height vs. width information in order to calculate flow through a normal vent, such as a door. The second came when flow through a ceiling/floor opening and mechanical ventilation were included. We must now take one more step and define the spatial component of a compartment.

This version of CFAST includes routines to generate the files for the Smart Panel Project (ToPanel.exe) as well as an implementation of the Smoke View output (ToSmkView.exe).

New Key Words and Geometry

In the data file, there are key words for width (BR), depth(DR), and height(HR), absolute X and Y positioning of the object. Use x for distances along DR, y along BR and z along HR, as shown in Figure 1. The corresponding variables in the data file are

HI/F for the height HR
WIDTH for the width BR
DEPTH for the depth DR
CXABS for the x position of the lower, left, bottom corner
CYABS for the y position of the lower, left, bottom corner.

Key word: CXABS, CYABS Input: Absolute x, y coordinates of the lower, left, back corner of the room	
Compartment position (m)	The number of values on the line must equal the number of compartments in the simulation (see documentation for WIDTH).

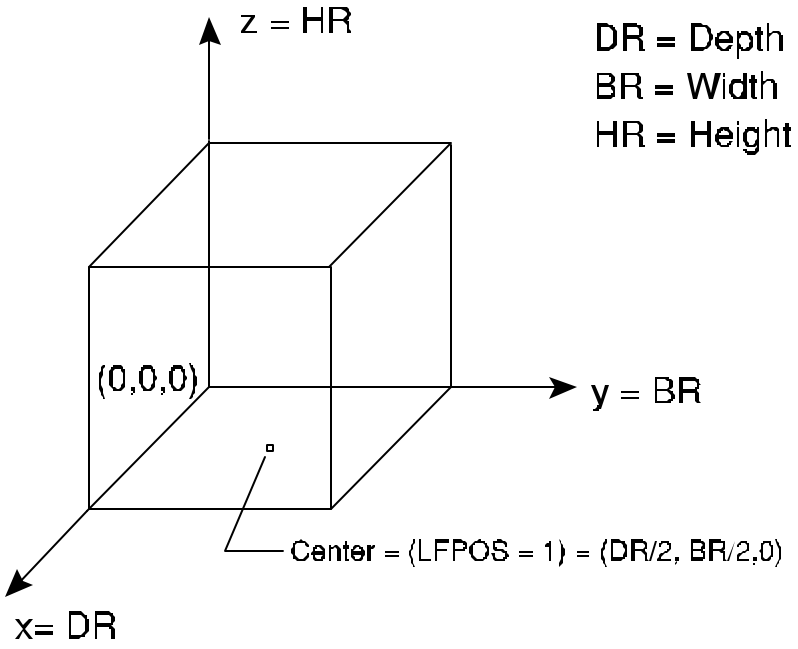
An additional geometry component is the placement and orientation of vents in walls, ceilings an floors. We will use the following terminology when dealing with spatial specifications. The convention that will be used is that the lower, left, back corner is the "0" of a compartment. The faces are then numbered counter clockwise:

1 has a normal vector of (1,0,0)
2 has a normal vector of (0,1,0)
3 has a normal vector of (-1,0,0)
and 4 has a normal vector of (0,-1,0).

Key word: HVENT Inputs: First Compartment, Second Compartment, Vent Number, Width, Soffit, Sill, Wind, First Compartment Offset, Second Compartment Offset, FACE

FACE	Optional parameter - 1, 2, 3 or 4: 1 => x-z plane, facing the negative y direction 2 => y-z plane, facing the positive x direction 3 => x-z plane, facing the positive y direction 4 => y-z plane, facing in the negative x direction

Both concepts are illustrated in the following figure. Please note that this figure shows the x,yz axes oriented with positive "x" out of the page. In the normal display in Smoke View, the figure is rotated -90° (that is, counter clockwise, looking down on the figure).



In this case, FACE 1 points to the left, 2 out of the page, 3 to the right, and 4 into the page.

Key word: INTER Input: Set initial interface height below ceiling - up to N_R 2 tuples (compartment, height)	
Compartment position (m)	The number of values on the line must equal the number of compartments in the simulation.

The initial interface height is normally at the ceiling of a compartment. When it is desired to set it at some other value, use INTER. Each invocation can have as many entries as desired, but they must be in pairs of (compartment $\leq N_R$, height)

example: INTER 2 1.2 3 2.0

would set the initial interface height in compartment 2 to 1.2 and compartment 3 to 2.0.

Key word: DTCHE Input: Minimum time step for calculations	
δt Count	Minimum time step, iteration count

Set the number of steps allowed with a time step less than δt. For example

DTCHE 1.0e-10 1000

would stop CFAST after 1000 iterations of the solver below a time step of $1.0x10^{-10}$. The default is $1.0x10^{-9}$.

Key word: SETP Input: File name for setting internal values
File name

This is primarily a development key word and should be used very carefully. The file named in the SETP command has a special format. The first line must be

FILE name of the data file referencing the SETP set. Lines 2 to the end are of the form

Compartment Value {'L' or 'U'} {'PRESS' TEMP' or 'INTER'}

For example, if DATA.DAT had the entry
SETP newdata.p0

then newdata.p0 might look something like

FILE DATA.DAT
1 230. U TEMP
2 101303. L PRES

Visibility

The conversion factor for visibility has been changed, based on the recent work by Mulholland and Croarkin[1]. The prior value for converting mass density in kg/m^3 was 3 500 and is now 3 817, reflecting more (and more accurate) experiments.

File Naming Convention

These are the suggested extension for input/output from the various routines:

data (input)	dat
Listing from CFAST (output)	lst

List data from CPLOT (ouput)	out
Spreadsheet from REPORTSS (ouput)	ss
Normal report, REPORT (output)	rs
Smoke View plot header (output)	smv
Smoke View plot file (output)	plt
History files	hi

We are in the process or changing the CFAST suite to be project oriented. At present, only TOSMKVIEW and TOPANEL require these extension. As the transition occurs, we will use these extensions. Once the transition is completed, only these extensions will be used by the routines.

1. G. W. Mulholland and C. Croarkin, Specific Extinction Coefficient of Flame Generated Smoke, Fire and Materials *24*, 227 (2000).